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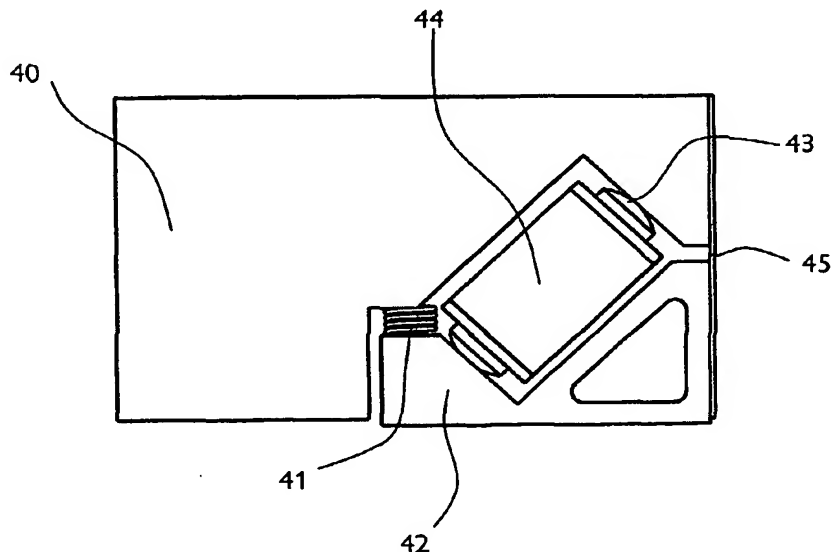
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[Continued on next page]

(54) Title: **ACOUSTIC ACTUATORS**



(57) Abstract: An acoustic transducer comprises an active element (21) which changes in length along a first axis in response to an audiofrequency input signal, the element being mounted between an inertial mass (20) and a foot (24) which in use engages a surface whereby audiofrequency vibrations produced by the active element are transmitted to the surface, characterised in that the foot is hinged (25) connected to the inertial mass and the active element is located between the foot and the mass such that the angle between the first axis and the surface is less than 90°, in use. Acoustic actuators with a magnetostrictive element having two statched coils, or with two magnetostrictive elements, the coils or elements having mutually different frequency response to achieve broader bandwidth are also disclosed.



European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 03/05616

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04R15/00 H04R17/00 H04R7/04 H04R1/24 H04R1/26  
H04R11/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 621 260 A (FRANCIS SYKES ADRIAN) 9 December 1952 (1952-12-09) column 1, line 1 - line 21 column 6, line 66 - column 8, line 4 column 8, line 24 - line 44 figures 4,9a	1-3,7-9
A		4-6,10
A	WO 02/076141 A (METHERINGHAM WILLIAM JOHN ; NEWLANDS TECHNOLOGY LTD (GB); SMITH BRIAN) 26 September 2002 (2002-09-26) cited in the application abstract page 3, lines 5-15 page 11, line 19 - line 29 page 12, line 8 - line 22 figures 1,3	1-10
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

13 July 2004

Date of mailing of the international search report

21.09.04

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 03/05616

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 366 748 A (ASHWORTH WILLIAM J) 30 January 1968 (1968-01-30) column 5, line 10 - column 6, line 6 figure 5	1
A	US 2 031 789 A (WASHINGTON PIERCE GEORGE) 25 February 1936 (1936-02-25) page 1, left-hand column, line 6 - line 10 page 2, right-hand column, line 10 - line 52 figures 1,2	1

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB 03/05616

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-10

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10

Acoustic actuator with an active element adapted to drive a panel forming an angle of less than  $90^\circ$  with the axis of the active element.

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2. claims: 11-13

Acoustic actuator with a magnetostrictive element with two stacked coils which are driven simultaneously and have mutually different frequency responses.

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3. claims: 14-19

Acoustic actuator for driving a single panel with two magnetostrictive elements having mutually different frequency characteristics.

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4. claims: 20-27

Acoustic actuator with two drivers each for driving a panel, wherein the second driver is mounted on the first driver.

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 03/05616

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2621260	A	09-12-1952	NONE
WO 02076141	A	26-09-2002	AU 4430001 A 03-10-2001 EP 1435190 A2 07-07-2004 WO 02076141 A2 26-09-2002
US 3366748	A	30-01-1968	NONE
US 2031789	A	25-02-1936	NONE